Money and government in the Roman Empire

RICHARD DUNCAN-JONES
Fellow of Gonville and Caius College, Cambridge
CONTENTS

List of plates page ix
List of figures ix
List of tables xii
Preface xv
Abbreviations xviii

PART I: THE ECONOMICS OF EMPIRE 1

1 Surplus and deficit 3
2 Money, prices and inflation 20
3 The imperial budget 33
4 Tax and tax-cycles 47

PART II: THE COIN-EVIDENCE 65

5 Coin-hoards and their origin 67
6 The implications of coin-hoards 86

PART III: MONEY AND MONEY-SUPPLY 95

7 Coinage and currency: an overview 97
8 The chronology of mint-output 113
9 Reign-studies: the chronology and structure of coin-output 126
10 The size of die-populations 144
11 The size of coin-populations 163
12 Mobility and immobility of coin 172
13 Weight-loss and circulation-speed 180
14 Wastage and reminting of coin 193
15 Change and deterioration 213
16 Contrast and variation in the coinage 238

APPENDIXES 248

1 Payments of congiaria 248
2 The chronology of minting under Tiberius 250
3 Variations in land-tax in Egypt 251
4 Assessments of tax-revenue in the sources 253
| 5 | Tax comparisons with Mughal India | 255 |
| 6 | Hoards below the sampling threshold | 256 |
| 7 | Rates of donative | 257 |
| 8 | Programs for finding negative binomial k and for estimating die-populations | 258 |
| 9 | Die-productivity in medieval evidence | 260 |
| 10 | Aureus and denarius hoards used in the main analysis | 261 |

_Bibliography_  
269

_Index_  
284
### PLATES

1. Concordia, denarius of Aelius Caesar (*RIC* 436)  
   *Page 153*
2. Pietas, denarius of Aelius Caesar (*RIC* 438)  
   *Page 154*
3. Concordia, aureus of Aelius Caesar (*RIC* 443)  
   *Page 156*
4. Pietas, aureus of Aelius Caesar (*RIC* 444)  
   *Page 156*
5. Hadrian on horseback, aureus (*RIC* 186)  
   *Page 156*
6. Hadrian galloping, aureus (*RIC* 187)  
   *Page 157*
7. Jupiter standing, aureus of Hadrian (*RIC* 63)  
   *Page 157*
8. Jupiter seated, aureus of Hadrian (*RIC* 64)  
   *Page 157*
9. Wolf and twins right, aureus of Hadrian (*RIC* 192)  
   *Page 158*
10. Vespasian crowned by Victory, aureus (*RIC* 105)  
    *Page 160*
11. Hercules with club, aureus of Trajan (*RIC* 49–50)  
    *Page 161*

### FIGURES

2.1 Prices for donkeys in Roman Egypt  
   *Page 30*
2.2 Annual percentages of coin in an Egyptian tetradrachm hoard, AD 50–220  
   *Page 31*
5.1 Concentrations of precious-metal hoards, HS500–900  
   *Page 69*
5.2 Concentrations of precious-metal hoards, HS1,450–2,000  
   *Page 69*
5.3 Concentrations of gold hoards, HS18,000–34,000  
   *Page 70*
5.4 Cumulated percentage value of gold coin in precious-metal hoards from Augustus to Severus Alexander  
   *Page 71*
5.5 Average number of precious-metal hoards per reign-year, Augustus to Severus Alexander  
   *Page 73*
5.6 Average value in sesterces of precious-metal hoards per reign-year, Augustus to Severus Alexander  
   *Page 73*
5.7 Correlation between number of precious-metal hoards and number of *congiaria* in Rome, AD 41–117  
   *Page 80*
5.8 Correlation between number of precious-metal hoards and number of *congiaria* in Rome, AD 161–235  
   *Page 80*
5.9 Aggregate value in sesterces of precious-metal hoards per *congiarium*, Augustus to Severus Alexander  
   *Page 81*
X

LIST OF FIGURES

5.10 Number of congiaria in Rome per reign-year, Augustus to Severus Alexander
6.1 Dating concentrations of Egyptian coin-hoards, AD 15–225
6.2 Dating comparison of Moldavian hoards beyond the frontier with empire hoards from the Danube region
7.1 Percentage profiles of coin-finds from military and civilian sites in Britain
8.1 Percentages of coin per year in two large tetradrachm hoards, AD 41–71
8.2 Percentages of Trajanic denarii in Reka Devnia and via Braccianese hoards
8.3 Annual percentages of denarii of Severus Alexander in Reka Devnia and Elveden hoards
8.4 Percentages of coin of different numbered officinae in the Normanby hoard and in twenty-two other hoards
8.5 Denarius coin: correlation between negative binomial k, and annual output ratios per reign
9.1 Percentages of denarii from silver hoards, aurei from gold hoards, AD 148–61
9.2 Percentages of denarii from silver hoards, aurei from gold hoards, and sestertii from hoards and finds. Coin of the Emperor, AD 148–61
13.1 Median weights (in grams) for four reigns in three gold hoards
13.2 Median weights (in grams) of eleven samples from five reigns in La Magura denarius hoard
13.3 Median weights (in grams) of reign samples in three denarius hoards
13.4 Median weights (in grams) of seven samples from six reigns in sestertii from the Garonne hoard
13.5 Median weights (in grams) from six reigns in the Puy-Dieu sestertius hoard
13.6 Percentage weight-loss per year for sestertii, denarii and aurei
14.1 Output-index values for 25 denarius hoards plotted by date
14.2 Percentage of Julio-Claudian coin before Nero in denarius hoards, AD 65–120
14.3 Percentage of Republican denarii in British hoards, AD 55–138
14.4 Percentages of Republican coin and of Julio-Claudian coin before Nero in denarius hoards
14.5 Median weight (in grams) of denarii of Antony in six British hoards
14.6 Percentage of coin of Nero in British denarius hoards
14.7 Percentage of coin of Trajan in British denarius hoards, AD 115–230
14.8 Percentage of coin of Trajan in British denarius hoards, AD 155–230
14.9 Percentage of coin of Hadrian in British denarius hoards, AD 155–230
14.10 Percentage of coin of Trajan in gold hoards, AD 135–215
14.11 Percentage of coin of Hadrian in gold hoards, AD 160–215
14.12 Percentage of coin of Nero in gold hoards, AD 75–215
LIST OF FIGURES

14.13 Cumulative percentages of Trajanic and Hadrianic coin in gold hoards, AD 160–215 209
14.14 Cumulative percentage of coin of Nero in gold hoards, AD 130–215 209
14.15 Cumulative percentage of Trajanic coin as a function of the cumulative percentage of Hadrianic coin in gold hoards, AD 160–210 210
15.1 The ratio of a pound of gold to a pound of silver in terms of implicit monetary value, Augustus to Severus Alexander 219
15.2 The number of denarii struck per pound of metal, Augustus to Severus Alexander 223
15.3 Approximate percentage coefficient of variation for denarius-weight (in grams), Augustus to Severus Alexander 224
15.4 Median percentage fineness of denarii struck for the Emperor, Augustus to Severus Alexander 226
15.5 Percentage coefficient of variation in denarius fineness, Augustus to Severus Alexander 226
15.6 Median percentage fineness as a multiple of median denarius-weight in grams, Augustus to Severus Alexander 228
15.7 The number of denarii struck per pound of silver, Augustus to Severus Alexander 229
15.8 Median percentage fineness of the denarius, AD 54–117 229
15.9 Percentage coefficient of variation in denarius fineness, AD 54–117 232
15.10 Percentage silver fineness of the Alexandrian tetradrachm, AD 14–190 235
15.11 Percentage coefficient of variation in fineness of the Alexandrian tetradrachm, AD 14–190 235
15.12 Percentage of zinc in orichalcum sestertius coin: twelve selected reigns, 31 BC–AD 192 237
16.1 Percentage of coin per year at Reka Devnia and median denarius fineness for four periods in the reign of Severus Alexander (standardised values) 239
16.2 Coin-weight (in grams) and percentage fineness in Walker's denarius sample, AD 112–17 243
16.3 Percentage fineness of denarii struck for the Emperor under Antoninus Pius 244

Appendix

6.1 Correlation between hoards in main sample and hoards in enlarged sample 256
TABLES

1.1 Surpluses, receipts, deficits and tax-remissions page 17
1.2 State expenditures 18
2.1 Average wine prices 26
2.2 Daily pay for harvesting 27
2.3 Daily cost of donkey-hire 27
2.4 Daily wages for digging 27
2.5 Chronological cost-comparisons using linear regression 28
3.1 The number of troops c. AD 200 and their cost 34
3.2 Provisional cost of army salaries 34
3.3 Annual cost of army salaries and praemia: schematic estimates 36
3.4 The cost of citizen procurators 37
3.5 Estimated civilian salary-costs 39
3.6 The cost of congiaria and donatives: schematic estimates 41
3.7 Schematic estimates of the Empire’s annual budget 45
4.1 Overall tax-rates in nine lists 49
4.2 The percentage of public land in seven Egyptian land-lists 49
4.3 The percentage of public land in local samples 50
4.4 Tree-crops: specimen tax-rates 51
4.5 Poll-tax: specimen rates 52
4.6 Estimates of tax-revenue in Egypt under the Principate 53
4.7 Early and late tax-rates in grain 57
4.8 The fifteen-year tax-cycle and tax-events, AD 41–180 60
5.1 The face-value of gold as a proportion of gold and silver in stray finds 72
5.2 Regional summary of hoard-sample 74
5.3 Analysis of hoards by region 75
5.4 The regional incidence of gold coin in hoards 76
5.5 Summary of hoards and congiaria for fifteen major reigns 79
8.1 Stray finds of gold coin from France as percentages 117
8.2 French stray-gold finds compensated for wastage and circulation-period 118
8.3 Gold hoards compensated for wastage 119
8.4 Hoard and stray gold profiles compared 119
8.5 A matrix of gold output 120
8.6 Comparisons of pre-Neronian gold output 120
8.7 Index of silver output for major reigns 124
8.8 Percentage chronology of gold and silver, AD 64–180 124
LIST OF TABLES

9.1 Early silver minting by Severus Alexander shown by year 127
9.2 Vespasian: median annual percentages for gold and silver 128
9.3 Trajan: median annual percentages for gold and silver 128
9.4 Trajan: bronze, silver and gold 129
9.5 Hadrian: bronze, silver and gold 130
9.6 Reka Devnia: denarii struck for Severus and Caracalla 134
9.7 Reka Devnia: denarii struck for Severus 134
9.8 Septimius Severus: denarius-types per year at Reka Devnia 135
9.9 Severus: coins per type at Reka Devnia 136
9.10 Severus for Caracalla: coins per type at Reka Devnia 136
9.11 Severus for Geta, Domna and Plautilla: coins per type at Reka Devnia 137
9.12 Reign of Severus: 'male' coin of periods 2–5 at Reka Devnia 137
9.13 Reign of Severus: provenance of Reka Devnia coins of Severus and Caracalla 138
9.14 Caracalla: silver coin at Reka Devnia struck in the Emperor's name 139
9.15 Reka Devnia: coins per type from the Rome mint, AD 199–216 140
9.16 Empress and Emperor at Reka Devnia: denarii per type 140
9.17 Coin of Empress-Dowagers as a fraction of Emperor coin (Reka Devnia) 141
9.18 Production-ratios under Marcus Aurelius (Reka Devnia) 141
10.1 Concentrations of the European red mite on apple trees in Connecticut 146
10.2 Reka Devnia: type-totals and type-predictions for ten major reigns using Method A 147
10.3 Carter estimates of missing Crepusius reverse dies 149
10.4 Negative binomial estimates of missing Crepusius reverse dies 150
10.5 Aelius TR POT COS II CONCORD denarii and aurei 152
10.6 Aelius TR POT COS II PIETAS denarii and aurei 152
10.7 Aelius die-totals projected by negative binomial 152
10.8 Aelius denarii: obverse dies 154
10.9 Obverse and reverse dies in Aelius's denarii: Aelius rt undraped obverse 155
10.10 Hadrianic gold dies 158
10.11 Die Projections for Hadrianic gold 159
10.12 Silver from Aelius gold-types: reverse dies 160
10.13 Gold-types of Vespasian and Trajan 161
11.1 Estimates of gold and silver coin by reign: AD 64–180 167
11.2 Estimates of silver coin by reign: AD 64–235 168
11.3 Coin-survival: the ratio between samples and projected numbers 171
12.1 Main components of three gold hoards 173
12.2 A coefficient of divergence applied to gold hoards 173
12.3 Spearman correlations between types in common 174
13.1 Weights in the Belgian gold hoard 182
13.2 Median weights in two gold hoards 182
13.3 Median weight at La Magura of coin struck for the Emperor (AD 196) 184
13.4 Median weights of pre-Severan coin struck for the Emperor in three silver hoards 184
13.5 Projected end-date and latest coin in denarius hoards 185
13.6 Garonne hoard: sestertii struck for the Emperor 188
13.7 Regression applied to later Garonne samples of sestertii struck for the Emperor 188
13.8 Number of sestertii struck to the pound 188
13.9 Median weight in the Puy-Dieu sestertius hoard (AD 244/9) 189
13.10 Dupondius-weight in the Garonne hoard 189
13.11 Summary of Roman rates of weight-loss as fractions of full coin-weight 191
13.12 Weight-loss in the English sovereign 192
14.1 Denarii of the Republic (including Antony) as a percentage in hoards of different dates 197
14.2 Median representation of six reigns in tetradrachm hoards 211
15.1 Projections of the Roman pound from Naples weights in the main zone of concentration (310–27 grams) 214
15.2 Change in the target weight of aurei from the Rome mint 216
15.3 Coins per pound of metal and nominal gold:silver ratio 217
15.4 Denarius-weight under Augustus 220
15.5 The denarius: median weight and fineness 225
15.6 The number of denarius struck per pound of silver 227
15.7 Median denarius fineness: coin struck for the Emperor, 31 BC–AD 98 230
15.8 Median denarius fineness: coin struck for the Emperor, AD 98–192 231
15.9 Median denarius fineness: coin struck for the Emperor, AD 193–235 232
15.10 Fineness of the Alexandrian tetradrachm and of the denarius 234
15.11 Mean zinc percentage in orichalcum coin (sestertii and dupondii) 236
16.1 Comparisons of median fineness before and after accession issues 238
16.2 Fineness and denarius-output under Severus Alexander 239
16.3 Differences in median denarius-weight under Vespasian 240
16.4 Contemporary differences in median denarius fineness, AD 157–69 241
16.5 Differences in median denarius-weight, AD 176–80 241
16.6 Comparisons between denarius-weight and and fineness: median weight of less fine specimens as a percentage of median weight of finer specimens 242
16.7 Egypt (114/17) compared with Londonthorpe (153/4) 245
16.8 Drzewicz Nowy compared with Viuz-Faverges 245
16.9 La Puriceni (194/5) compared with La Magura (196) 246
A.1 Spending on congiaria, 31 BC–AD 235 249
A.2 Hiera Nesos: tax-rates by production-status and juridical type 252
A.3 Hiera Nesos: land-area by production-status and juridical type 252
A.4 Donatives and bequests to the troops in literary evidence 257